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The Technical Study and Physical Care of Paintings

by EDWARD W. FORBES

WE value human life, and rightly so, yet who among us would be hardy enough to state that the preservation of his life for a few years more or less would be of equal importance with the preservation of Michelangelo's frescoes in the Sistine Chapel? We are born to die; these frescoes are born to live. How many among us can bear as important a part in the civilization of the world, and can carry as rich a freight of inspiration to countless thousands of our fellow-men for generations to come, as Botticelli's *Primavera*, or one of Titian's masterpieces? I would not minimize the importance of preserving our own lives but would emphasize that of preserving the lives of our pictures. When we die, others will take our places; but what would replace Leonardo da Vinci's Last Supper or the paintings in the Uffizi, should they perish?

Why have we the privilege today of looking at the works of Giotto, Botticelli, and Bellini? It is because these masters learned their trades just as carpenters, masons, or gilders may do now. Moreover, they had the advantage of working in the guild system rather than in the trades union system. The guilds insisted that the public should be well served, that good materials should be used, and that the work should be honestly done; whereas our trades unions concentrate their supreme effort on seeing that the men are well paid, not that the public gets its money's worth. There is much to be said for the apprentice system. Let us hope that modern intelligence will some day apply itself to the problem of the production of great works of art. If careful study shows that certain mediaeval conditions tended to produce masterpieces, is it too much to hope that in the future we may, either unconsciously or consciously, work towards re-creating these same conditions or towards devising new ones equally effective?

Broadly speaking, the subject of this paper has three aspects: the study of the authenticity of the picture, which is highly important to the purchaser or to the cataloguer; the study of the physical condition and care of the picture, which is very necessary to the owner or to the curator; and finally the study of the soundest technical methods and materials, which is especially essential to the artist and to his manufacturer.

The first division of the subject involves the complicated problem of determining whether a picture is genuine and whether it is valuable. Technical investigation is, of course, only one of the many lines of approach. Historical and iconographical knowledge, wide experience, intimate acquaintance with the works of the great masters, and, above all, that subtle sort of sixth sense known as the *flair* are the usual means of determining what a picture is. Through technical knowledge, however, a great deal of useful evidence may be obtained. This knowledge is serviceable, to be sure, only up to a certain point. We know, for instance, what woods were commonly used for panels, but a Madonna on a mahogany panel or on canvas is not necessarily modern, for it may have been transferred from its original poplar panel. We know what pigments were used in the various periods. This may prove to be valuable testimony, but it is not an infallible test. Certain colors can be determined without removal from the picture by the use of a microscope that magnifies to one hundred diameters. Other colors are harder to verify, and it is necessary to take a grain, smaller than a pin head, from the picture by means of a hypodermic needle. I have never done this, but Professor Laurie describes the process in his book. The owner of a picture would often refuse to allow even this tiny speck to be taken, but it is sometimes possible to find an unimportant part of the drapery under the frame, where the removal of a bit will do no damage. Genuine ultramarine and azurite, the principal blues used by the early Italians, can be recognized and distinguished from cobalt and artificial ultramarine, which have been used since 1830. But here again, the problem is complicated by the fact that a

given blue drapery in an old picture may have been repainted with modern blue or a clever deceiver may have used the old color in his forgery. Among other significant details are the peculiar cracks produced by various kinds of grounds, pigments, media, and varnishes; the brush work used in tempera, as opposed to that in oil painting; the different kinds of under-painting practiced by the old masters; and the different systems of glazing.

There is, of course, one objection to teaching the secrets of the old masters too widely. Is it not possible that the forgers will avail themselves of this information more readily than the scholars and critics, just as the wide publication of ingenious new crimes in the papers may merely add to the *répertoire* of the criminals and probably will help little toward putting the public on its guard? Yet the most accomplished forgers have much of this information already; and, in spite of the danger of helping them further, I feel that it is sound to publish the truth and to trust that the forgers will overreach themselves somewhere, and that the great body of technically trained students and painters will grow and grow, and may finally constitute such a weight of enlightened opinion that the clever but shallow mentality of the forger will be unable to keep up with the advance of knowledge. In these days, when an authentic painting by Raphael may be worth more than \$500,000, and a forged painting like Raphael less than \$500, it is of no small consequence to the purchaser, particularly if he is a museum official spending public money, to know whether a given picture is genuine or not. Unfortunately, as we learn more, our enemy the forger learns more also, just as one group of men invent heavier cannon to pierce the defenses and another group improve the defenses to guard against the cannon.

It is unnecessary here to speak of the literature on our subject. The more important books are too well known to need comment, but there are many minor books which might well repay the research of some student—books of recipes and of secrets concerning the

mysteries of alchemy. It is still possible to find material which has not been unearthed by Eastlake, Mrs. Merrifield, Laurie, or any of the other investigators, and thus to clear up disputed points. At the Fogg Museum are a number of rare books relating to the technique of painting, and more are being collected.

At the present time a great deal might be done by experimenting with the materials used by the mediaeval painters. By means of this we may hope to find eventually some forgotten secrets which will enable us to take better care of our old pictures and to produce more durable new ones.

The second division of our subject concerns the care of paintings. The American public is under a heavy responsibility. An immense number of very valuable paintings have poured into America during the last twenty years and millions of dollars' worth are coming in every year. These pictures are often bought by successful bankers and manufacturers who have had no experience in the care of pictures and who place them in their steam-heated houses. On the whole, the panels are in greater danger than the canvases. During the summer, when the humidity of the air frequently goes up to eighty degrees or more, the panels swell, as do our doors which refuse to shut in the summer. In the winter, when our furnaces are lighted and the humidity sinks often to thirty degrees, the panels shrink as they dry, just as our throats become dried and subject to the colds that attack us through the winter. The gesso surface which holds the pigment does not swell and shrink as much as the wood does; hence it gradually works loose and peels off. Not only panel paintings, but also valuable furniture, stucco reliefs, wood carvings, and other objects of art suffer in a like manner. It is said that no such low humidity as this ever exists even in the Sahara. In general the atmospheric conditions of this country are much worse for panels than are those of Europe.

Canvas, on the other hand, is exposed to its own set of dangers, in some ways greater, in some ways less, than those which menace panels. It seems to me that, if

through the greater wealth of this country we take advantage of the unfortunate conditions in Europe during the coming years and buy a large number of important paintings which do not already permanently belong to public museums, and if we then fail to take adequate care of them, we shall commit a serious crime against civilization. The obvious first steps are to avoid most of our difficulties by maintaining proper humidity in our houses and museums (a move which will be just as beneficial to us as it is to our pictures) and to guard against excessive heat and cold, noxious gases, dirt, flies, and physical injury of various sorts. It is difficult to keep atmospheric conditions constant; in the Fogg Museum we have suffered many trials with pictures because we cannot afford the expensive humidifying plant that is necessary to produce proper conditions, and, in fact, no special effort has been made to secure money for this purpose for we are in an outgrown museum and hope soon to have a better building.

The life of a picture depends partly upon the city in which it is. Mr. Toch points out in his book that the acid gases which are produced by the burning of coal, notably of soft coal, are very injurious to certain pigments. Thus, the Pittsburgh collectors, for instance, who buy valuable pictures which are painted with those pigments have to be particularly careful.

The question of whether glass should be put in front of a picture is a troublesome one. Glass does, indeed, ward off some ills as far as the surface of the picture is concerned. But if the front of the painting which is already protected with a varnish has the additional protection of glass, then the back also should be protected from moisture. Sir Arthur Church calls attention to the fact that the back of the paper on which water colors and drawings are executed should on no account be in contact with any kind of wood. Of course, it is well known how disastrous the exposure to sunlight has proved in the case of water colors by Turner and others. If oil paintings are in too dark a place they suffer from one set of ailments; if they are in too light a place they suffer from another set, especially

from certain so-called chemical rays that come from the sun. Sir William Abney devised for the Victoria and Albert Museum at South Kensington an arrangement of colored glass of peacock blue and yellow, which excluded certain injurious rays. In England museum officials have tried the experiment of covering the walls of the museum with white lead in a tempera medium of starch water. The walls so prepared absorb the various sulphurous acids that penetrate into the building. The pictures, which are less susceptible than the walls, partly because of their varnish, thus escape almost entirely the effects of these dangerous chemicals in the air. As Professor Ostwald points out, one of the troubles with oil paintings is that the process of oxidation does not stop. "Every oil painting is in a process of continual change and this change takes place with a varying velocity depending on the nature of the pigment which is mixed with the oil. This is the cause of the numberless diseases to which oil paintings are subject." So it is a mistake to believe that there are only one or two kinds of trouble that afflict pictures. There are many; and it is important that the restorer should diagnose the difficulty correctly. If a picture does begin to go to pieces we have to go to the professional restorer. It is most dangerous and improper for any amateur to try to repair or restore a picture.

The choice of the restorer is one of the most difficult problems for the owner of pictures. There are many commercial restorers in this country. They are men who are all too often trained to believe that the ideal of restoration is to make the picture look as if it had never suffered. The more skillful and more conscientious ones content themselves with securing what is left of the old picture and with touching in the parts of the surfaces that are actually damaged; but there are others who fail to match the tint exactly and who find that the easiest way is to carry their colour over the original surface, rather than to try any longer to match the subtle tint used by the master. In such cases they usually conceal their repainting by a heavy coat of varnish which gives the picture a glossy surface, most pleasing

to those who know the least. This varnish may last for fifty or one hundred years. When its term of life draws to an end it turns dark and then it is removed by the restorer of that day. With the varnish, often some of the repaint, and probably some of the original paint, comes off. The picture is made "as good as new" again and lasts another fifty years or so. We can easily see how after three or four centuries of such treatment many pictures that were once by Rembrandt or Titian may have nearly forfeited that title, particularly as the delicate glazes and scumbles, on which the masters depended for the final effect, are pretty sure to go at the first restoration. Picture restorers usually guard their secrets with jealous care. They have some reason for so doing: it is all too easy for young workmen to learn a smattering of the necessary recipes from their master and then to practice their half-baked knowledge and lack of skill on valuable pictures. The state prevents a first year medical student from trying to perform an operation for appendicitis, but there is nothing to stop the youthful picture restorer from practicing on Holbeins and Titians if he is plausible and persuasive enough to induce some ill-informed owner to let him treat the picture. We have to choose our restorers as we choose our doctors. But it is easier to judge the success of the doctors. The picture may appear to be cured, and the fact may not develop for twenty-five years that it was not saved but ruined. Bad restoring is often worse than nothing; good restoring may easily save a doomed painting from complete wreck and give it a new lease of life. The restorer artist who cannot refrain from repainting is in the same position as a doctor who might discover the secret of prolonging our lives by substituting new parts as the old ones wear out. The patients of such a doctor would have the alternative of living on with a motley assortment of eyes, ears, noses, arms, and legs, or of living their natural lives and finally sinking into their respectable and individual graves. I fear that we are a long way from state control of such matters, but the steps leading in the right direction are

for all owners of pictures and museum officials to make it their duty to acquire at least an elementary knowledge of this difficult subject.

The third division of our subject deals with the technique of painting from the standpoint of present work. In order to create today pictures that will last we should be familiar with the enduring and with the un-enduring pictures of the past and of the present. This field of study includes the questions of materials, whether wood, plaster, canvas, or copper; of grounds, on which the paint is to be placed; of pigments and media, and the methods of laying them on the surface; and, last and far more difficult than all the rest, of varnishes.

There is something to be said for each material. Vellum, ivory, and well made paper are excellent for illuminations, miniatures, drawings, and water colors. Copper has certain advantages for oil and tempera paintings, provided the paint can be made to adhere—a feat which has often been accomplished. Wood, such as well seasoned mahogany, is probably the best of all. Canvas, which offers many advantages, entails corresponding difficulties. Oil tends to make the canvas rot, hence a coat of priming must be put between the oil and the canvas. This coat of priming is commonly prepared and put on by a commercial concern that is in the business to make money. The artist does not know what cheap or inferior materials may have been employed for this purpose, whether it is chemically pure, or how it will affect the particular pigments which he uses. One difficulty is that if we use for the priming of either a panel or a canvas a substance like casein, which the water cannot penetrate, it is too hard and brittle, and if we mix in glycerine to soften it and make it elastic, we introduce a highly hygroscopic element, which is undesirable. Professor Ostwald recommends pasteboard with casein and perhaps linen over it, in place of canvas; others say that the pasteboard may contain injurious chemicals and that casein is dangerous. Many modern chemists have made careful studies of the durability of pigments. The artist can buy such a book as Church's *Chemistry of Paints and Painting* and inform

himself as to what pigments are sound. There is, however, a curious lack of consistency between the experiments of the various authorities. Some say that a given color is permanent, and others, that it is not. So in regard to these disputed points we can only trust that still more authorities will make similar studies and that eventually a conclusive consensus of opinion will be reached.

Provided that the ground is good and the pigment is good, the problem of the medium need not be very difficult. The water colors and oils prepared by the most reputable firms are usually trustworthy. When experiments are made in tempera they had better be done with some established and well tried formula, such as the yolk of egg, which is known to have lasted for centuries. If some new medium is tried, it ought to be well understood and known to be chemically sound. The question of whether a varnish medium may be used opens up a very complicated problem involving the study of the famous Van Eyck medium, which is thought to have been an emulsion. In this short space I cannot go into the question further than to say that if a varnish medium is to be used, it must be exactly right, for when we approach the problem of varnishes and of the nature and use of these fascinating resins, we are on dangerous ground. Like fire and water, they are both the preserver and friend and the destroyer and enemy. If a picture is not varnished, it is exposed to one set of dangers; if it is varnished, it is exposed to another and perhaps worse set.

There are many different kinds of resins, and the problem is much complicated by the infinite number of possible combinations and mixtures. As is well known, the principal resins are amber, copal, sandarac, and mastic. There are a great many different kinds of copal. The vagueness of the mediaeval terminology is a source of much difficulty. When mediaeval writers mention amber or sandarac, we are not sure that they are talking of the same resins as those we know by the names. When it is remembered that the early masters made various mixtures of resins with balsams, such as

Venice turpentine, and with oils such as linseed oil or nut oil, it will readily be seen that our difficulties do not decrease.

Varnish can safely be used by the master, but the ignorant should beware of playing with fire. It is possible for a competent restorer to varnish a picture in such a way that the risk will be slight. Perhaps the greatest among the many dangers is that the varnish will eat down into the pigment; and then, when fifty or one hundred years later the varnish is removed, a large part of the original paint will be removed also. There are various possible ways to avoid this difficulty. Professor Ostwald suggests putting between the paint and the varnish a layer of a transparent substance composed of a solution of celluloid which contains different properties from its neighbors. Thus when the varnish turns brown and opaque at the end of its life, the solvent which removes it will leave the celluloid and, of course, the paint below untouched.

I hope that some day a technical school may be established, perhaps at Harvard, where the painters, restorers, and museum officials may learn about the chemistry of paintings and the care of them, on strictly scientific principles. We cannot expect every artist to prepare his own panels and grind his own colors. We do not all know how to inspect the milk and the water supply. But we all want good milk and water. I think it might be possible for the artists to form some sort of a national guild. The guild would employ professional men to examine the pigments and canvases produced by various firms. Then, those who were particular could insist on using certified materials. There are pictures painted a few years ago by famous living artists which are already going to pieces. When we pay five thousand dollars for the portrait of a member of our family we want it to last for a few years at least. I hope that when it becomes apparent to the public that our artists are often ignorant and careless about these matters and that our picture collectors and museum officials are not always perfectly informed about the care of pictures, the de-

mand for this study will grow. Please do not think, however, that I believe the technique is an end in itself. It can interest us for a moment while we look at the great work of art, and then we can forget the means and look beyond. George Herbert said:

“A man that looks on glass
On it may stay his eye;
Or if he pleaseth through it pass
And then the heaven espy.”